AQA GCSE Chemistry | 8462

SPECIFICATION POINT 4.2.3.1

Diamond

Past-paper questions

Tier	**Foundation**
Question groups	**8**
Available paper years	**2008–2024**

Using this booklet

1. Answer the questions in order and show your working.
2. Original question numbers and marks are retained.
3. Print at actual size (100%) for measuring questions.
4. Use the companion answer booklet to check your work.

Name: _____ **Date:** _____

Whole questions are retained for context, so some parts assess other specification points. Current and legacy sources are labelled. Continue on extra paper if needed.

4.2.3.1 Diamond

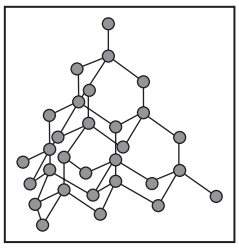
Question 01

January 2008 | CHY2F | Original Q2 | Legacy

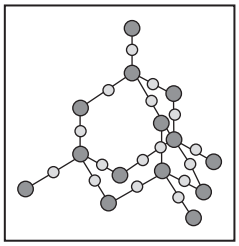
2 This question is about giant structures. Diamond, graphite and silicon dioxide all have giant structures.

(a) The diagrams show the structures of these three substances.

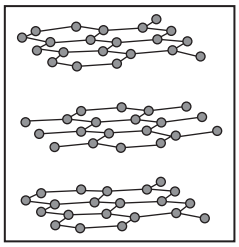
Draw a line from each structure to its name.



Silicon dioxide



Graphite



Diamond

(2 marks)

4.2.3.1 Diamond

Question 01 · continued

BLANK

(b) Complete the sentences using words from the box.

covalent	**four**	**hard**	**ionic**
shiny	**soft**	**three**	**two**

(i) Diamond, graphite and silicon dioxide have high melting points because all the atoms in their structures are joined by strong ..... bonds.
(1 mark)

(ii) In diamond each atom is joined to ..... other atoms.
(1 mark)

(iii) Diamond can be used to make cutting tools because it has a rigid structure which makes it very ..... .
(1 mark)

(iv) In graphite each atom is joined to ..... other atoms.
(1 mark)

(v) Graphite can be used to make pencils because it has a structure which makes it ..... .
(1 mark)

(c) When a diamond is heated to a high temperature and then placed in pure oxygen it burns. Carbon dioxide is the only product.

Name the element in diamond. .....
(1 mark)

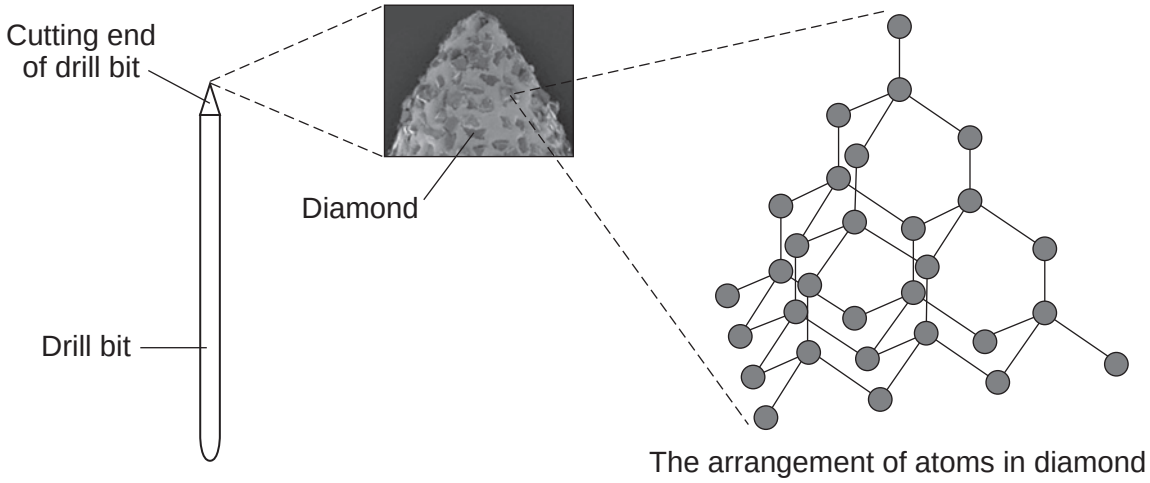
8

4.2.3.1 Diamond

Question 02

June 2010 | CHY2F | Original Q4 | Legacy

4 A drill bit is used to cut holes through materials. The cutting end of this drill bit is covered with very small diamonds.



The arrangement of atoms in diamond

Draw a ring around the correct word in each box.

4 (a) Diamond is made from [carbon / nitrogen / oxygen] atoms.

(1 mark)

4 (b) Diamond has a giant structure in which [none / some / all] of the atoms are joined together.

(1 mark)

4 (c) The atoms in diamond are joined together by [covalent / ionic / metallic] bonds.

(1 mark)

4.2.3.1 Diamond

Question 02 · continued

4 (d) In diamond each atom is joined to [two / three / four] other atoms.

(1 mark)

4 (e) Diamond is suitable for the cutting end of a drill bit because it is [hard. / shiny. / soft.]

(1 mark)

5

Turn over for the next question

4.2.3.1 Diamond

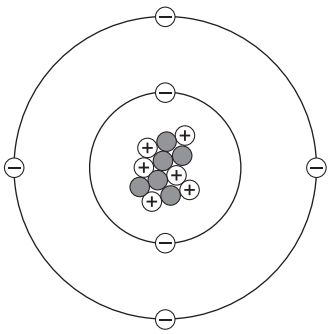
Question 03

January 2012 | CH1FP | Original Q1 | Legacy

1 The picture shows a diamond ring.



1 (a) Diamond is a form of carbon. The diagram represents a carbon atom.



Complete the table to show the name and charge of each type of particle in the carbon atom.

Name of particle	Charge
proton	
neutron	0
	–1

(2 marks)

4.2.3.1 Diamond

Question 03 · continued

1 (b) Use the Chemistry Data Sheet to help you to answer these questions.

1 (b) (i) Draw a ring around the correct answer to complete the sentence.

Gold and carbon are

compounds.

elements.

mixtures.

(1 mark)

1 (b) (ii) Complete the sentence.

Gold and carbon have different properties because gold is a metal and carbon is a ..... .

(1 mark)

1 (c) Draw a ring around the correct answer to complete each sentence.

Pure gold is not used to make the ring because pure gold is too

hard.

reactive.

soft.

The gold ring is made by mixing pure gold with other metals to form

a compound.

an atom.

an alloy.

(2 marks)

Question 1 continues on the next page

4.2.3.1 Diamond

Question 03 · continued

1 (d) The data in the table shows some information about the three metals in the gold ring.

Name of metal	Atomic number	Percentage (%) of metal
gold	79	
silver	47	16
copper	29	9

Draw **one** line from each question to its correct answer.

Question	Answer
What is the percentage of gold in this ring?	29
	61
How many electrons are there in a copper atom?	75
How many neutrons are in an atom of silver with a mass number of 108?	79

(3 marks)

9

4.2.3.1 Diamond

Question 04

June 2013 | CH2FP | Original Q3 | Legacy

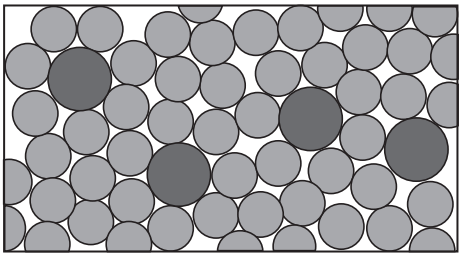
3 Oil rigs are used to drill for crude oil.



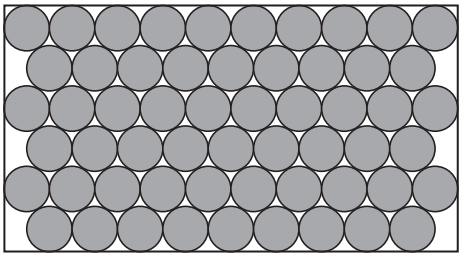
3 (a) Drills are made from an alloy of iron.

The diagrams show the particles in the alloy and in pure iron.

Alloy



Pure iron



Use the diagrams to explain why the alloy is harder than pure iron.

.....

.....

.....

.....

(2 marks)

3 (b) Drill heads contain diamonds.

Tick (✓) **two** reasons why diamonds are hard.

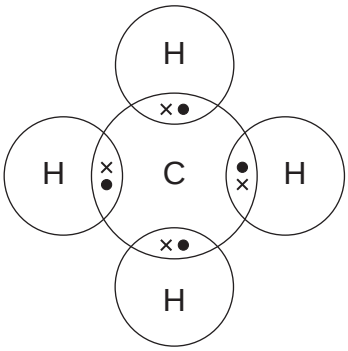
Reason	Tick (✓)
Diamonds have a giant covalent structure.	
Diamonds have high melting points.	
Diamonds are unreactive.	
Diamonds have strong bonds between carbon atoms.	

(2 marks)

4.2.3.1 Diamond

Question 04 · continued

3 (c) Methane gas is often found where crude oil is found.
The diagram shows how atoms bond in methane.
Only the outer electrons are shown.



3 (c) (i) Draw a ring around the correct answer to complete the sentence.

Methane is

a compound.

an element.

a mixture.

(1 mark)

3 (c) (ii) Draw a ring around the correct answer to complete the sentence.

The formula of methane is

C_4H_4

C_4H

CH_4

(1 mark)

3 (c) (iii) Name the type of bond between the carbon and hydrogen atoms in methane.

.....

(1 mark)

3 (d) Explain why methane is a gas at 20 °C.

.....

.....

.....

.....

(2 marks)

9

4.2.3.1 Diamond

Question 05

June 2014 | CH2FP | Original Q1 | Legacy

1 This question is about diamonds.

Draw a ring around the correct answer to complete each sentence.

1 (a) Diamonds are found in meteorites.

1 (a) (i) Meteorites get very hot when they pass through the Earth's atmosphere, but the diamonds do not melt.

Diamond has a (high / low / very low) melting point.

[1 mark]

1 (a) (ii) Most diamonds found in meteorites are nanodiamonds.

A nanodiamond contains a few (hundred / thousand / million) atoms.

[1 mark]

1 (b) Diamonds are used for the cutting end of drill bits.

Diamonds can be used for drill bits because they are (hard. / shiny. / soft.)

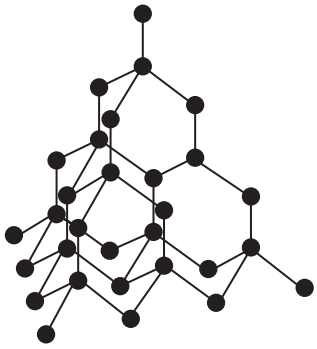
[1 mark]

4.2.3.1 Diamond

Question 05 · continued

1 (c) **Figure 1** shows the arrangement of atoms in diamond.

Figure 1



1 (c) (i) Diamond is made from [carbon / nitrogen / oxygen] atoms.

[1 mark]

1 (c) (ii) Each atom in diamond is bonded to [three / four / five] other atoms.

[1 mark]

1 (c) (iii) Diamond has a giant [covalent / ionic / metallic] structure.

[1 mark]

1 (c) (iv) In diamond [all / none / some] of the atoms are bonded together.

[1 mark]

7

4.2.3.1 Diamond

Question 06

June 2016 | CH2FP | Original Q2 | Legacy

2 This question is about substances containing carbon atoms.

2 (a) Diamond is made of carbon atoms.

2 (a) (i) Diamond is used for tips of drills.

Figure 3 shows a drill.

Figure 3



Give **one** reason why diamond is used for tips of drills.

[1 mark]

_____

_____

2 (a) (ii) Diamond nanoparticles can be made.

Use the correct answer from the box to complete the sentence.

[1 mark]

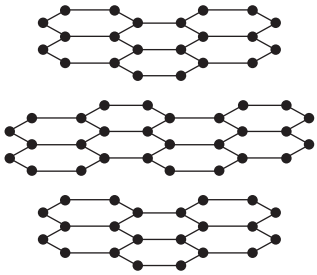
hundred	**million**	**thousand**

Nanoparticles contain a few _____ atoms.

2 (b) Graphite is made of carbon atoms.

Figure 4 shows the structure of graphite.

Figure 4



4.2.3.1 Diamond

Question 06 · continued

2 (b) (i) What type of bonding does graphite have?

[1 mark]

Tick (✓) **one** box.

Covalent ☐

Ionic ☐

Metallic ☐

2 (b) (ii) How many carbon atoms does each carbon atom bond to in graphite?

[1 mark]

Tick (✓) **one** box.

1 ☐

2 ☐

3 ☐

4 ☐

2 (b) (iii) What is a property of graphite?

[1 mark]

Tick (✓) **one** box.

Dissolves in water ☐

Has a low melting point ☐

Soft and slippery ☐

Question 2 continues on the next page

4.2.3.1 Diamond

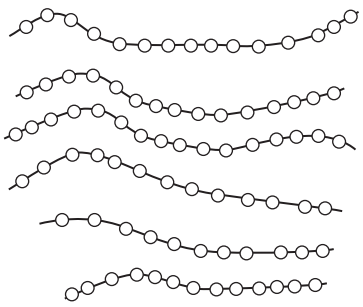
Question 06 · continued

2 (c) Poly(ethene) is made of carbon and hydrogen atoms.

Poly(ethene) is a thermosoftening polymer.

Figure 5 shows the structure of a thermosoftening polymer.

Figure 5



2 (c) (i) Complete the sentence.

[1 mark]

Between the polymer chains in a thermosoftening polymer there

are no _____ .

2 (c) (ii) Use the correct answer from the box to complete the sentence.

[1 mark]

condense	**dissolve**	**melt**

Heating would cause a thermosoftening polymer to _____ .

2 (c) (iii) Many ethene molecules react together to make poly(ethene).

Different types of poly(ethene) can be made by changing the conditions for the reaction. Suggest **two** conditions that could be changed.

[2 marks]

1 _____

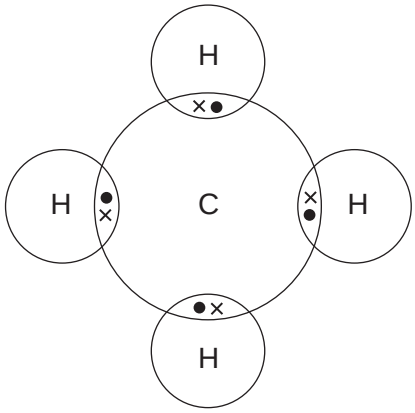
2 _____

4.2.3.1 Diamond

Question 06 · continued

2 (d) **Figure 6** shows how the atoms are bonded in methane.

Figure 6



2 (d) (i) What is the formula for methane?

[1 mark]

Tick (✓) **one** box.

C_4H ☐

CH_4 ☐

C_4H_4 ☐

2 (d) (ii) Methane has a low boiling point.

What does methane consist of?

[1 mark]

Tick (✓) **one** box.

Charged ions ☐

A giant lattice ☐

Small molecules ☐

11

4.2.3.1 Diamond

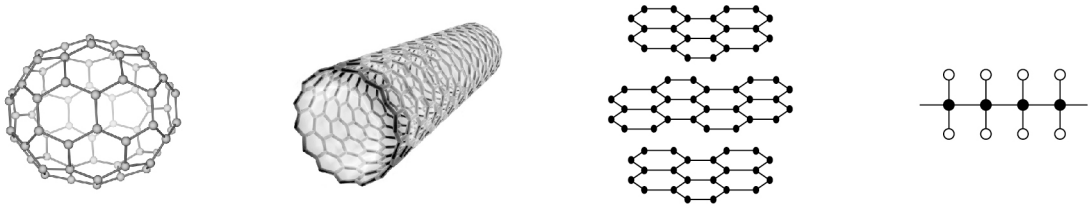
Question 07

June 2022 | 8462/1F | Original Q6

0 6 This question is about carbon and compounds of carbon.

Figure 9 shows diagrams that represent different structures.

Figure 9



A **B** **C** **D**

Use **Figure 9** to answer questions **06.1** and **06.2**.

0 6 . 1 Which diagram represents graphite?

[1 mark]

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐

0 6 . 2 Which diagram represents poly(ethene)?

[1 mark]

Tick (✓) **one** box.

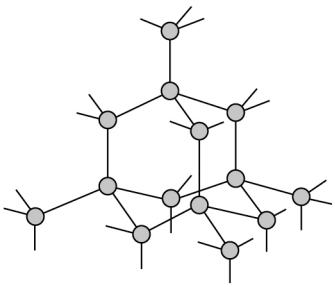
A ☐ **B** ☐ **C** ☐ **D** ☐

4.2.3.1 Diamond

Question 07 · continued

Figure 10 represents the structure of diamond.

Figure 10



0 6 . 3 How many covalent bonds does each carbon atom form in diamond?

[1 mark]

0 6 . 4 Which is a property of diamond?

[1 mark]

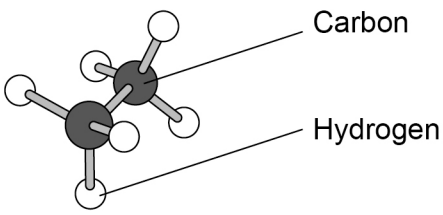
Tick (✓) **one** box.

- Conducts electricity ☐
- Low melting point ☐
- Very hard ☐

Question 6 continues on the next page

0 6 . 5 **Figure 11** shows a model of a molecule.

Figure 11



Complete the molecular formula of the molecule.

[1 mark]

Molecular formula = C__ H__

Carbonic acid is a compound of carbon.

The formula of carbonic acid is H_2CO_3

0 6 . 6 Which ion is produced by carbonic acid in aqueous solution?

[1 mark]

Tick (✓) **one** box.

H^+ ☐ OH^- ☐ O^{2-} ☐

0 6 . 7 Calculate the relative formula mass (M_r) of carbonic acid (H_2CO_3).

Relative atomic masses (A_r): H = 1 C = 12 O = 16

[2 marks]

Relative formula mass (M_r) = _____

8

4.2.3.1 Diamond

Question 08

June 2024 | 8462/1F | Original Q5

0 5 This question is about carbon and carbon compounds.

An atom of carbon is represented as:

(Mass number) 13
(Atomic number) 6 C

0 5 . 1 What is the number of protons in this atom of carbon?

Tick (✓) **one** box.

[1 mark]

1 ☐ 6 ☐ 7 ☐ 13 ☐

0 5 . 2 What is the number of neutrons in this atom of carbon?

Tick (✓) **one** box.

[1 mark]

1 ☐ 6 ☐ 7 ☐ 13 ☐

0 5 . 3 What is the number of electrons in this atom of carbon?

Tick (✓) **one** box.

[1 mark]

1 ☐ 6 ☐ 7 ☐ 13 ☐

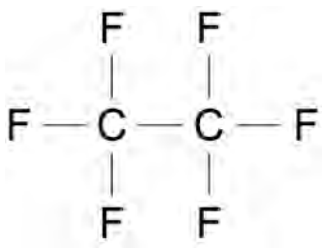
Question 5 continues on the next page

4.2.3.1 Diamond

Question 08 · continued

0 5 . 4 **Figure 10** shows the structure of a carbon compound.

Figure 10



Complete the formula of the carbon compound.

[1 mark]

C__ F__

0 5 . 5 Methane:

- is a carbon compound
- exists as small molecules
- has a low boiling point.

What is the reason for the low boiling point of methane?

[1 mark]

Tick (✓) **one** box.

Covalent bonds **and** intermolecular forces are weak. ☐

Only covalent bonds are weak. ☐

Only intermolecular forces are weak. ☐

4.2.3.1 Diamond

Question 08 · continued

0 5 . 6 Buckminsterfullerene (C_{60}) is a form of carbon.

Buckminsterfullerene was the first fullerene to be discovered.

What is the shape of a buckminsterfullerene molecule?

[1 mark]

Tick (✓) **one** box.

Cubic ☐

Cylindrical ☐

Spherical ☐

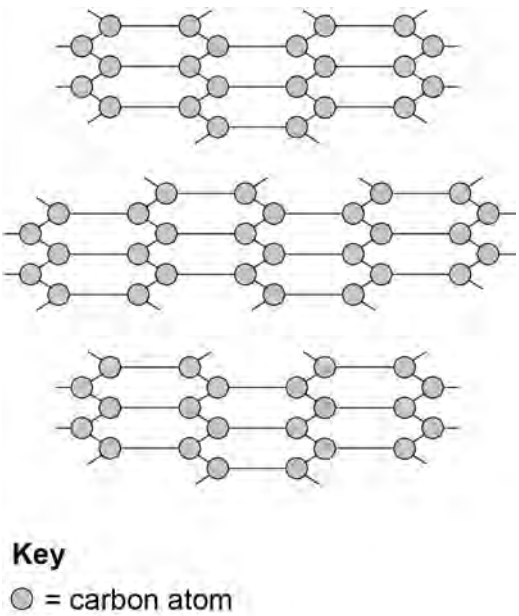
Question 5 continues on the next page

4.2.3.1 Diamond

0 5 . 7 Graphite is a form of carbon.

Figure 11 represents the structure of graphite.

Figure 11



How many covalent bonds does each carbon atom form in graphite?

[1 mark]

Tick (✓) **one** box.

1 ☐

2 ☐

3 ☐

4 ☐

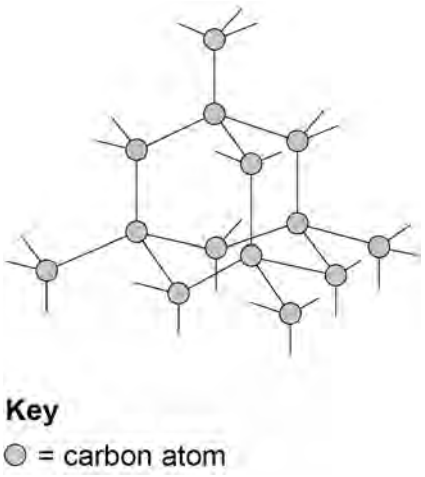
4.2.3.1 Diamond

Question 08 · continued

0 5 . 8 Diamond is another form of carbon.

Figure 12 represents the structure of diamond.

Figure 12



Describe the structure and bonding in diamond.

[3 marks]

10